

## PATENT ABSTRACTS OF JAPAN

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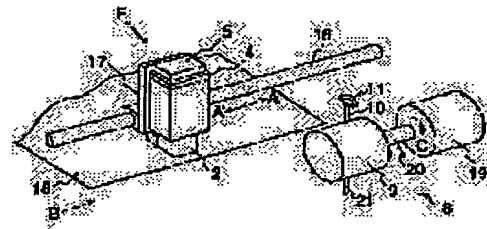
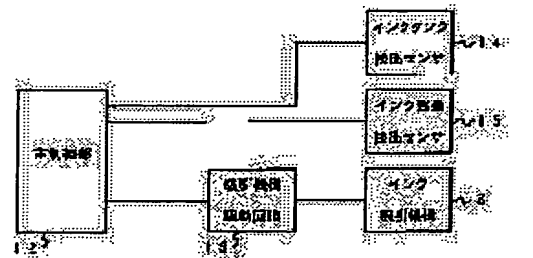
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## (54) INK-JET DEVICE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To enhance the consumption efficiency of ink by absorbing the necessary minimum amount of ink in response to the state of the remaining amount of ink by a method wherein a sucking means, which varies the sucking amount of an ink sucking mechanism, is controlled on the basis of the outputs of a first and a second detecting means.

**SOLUTION:** To a main controlling part 12 of an ink jet printer 1, a sucking mechanism driving circuit 13, an ink tank detecting sensor 14 and a remaining amount of ink detecting sensor 15 are connected. Further, an ink sucking mechanism 8 is connected to the sucking mechanism driving circuit 13, which controls the amount of ink sucked by the ink sucking mechanism 8 on the basis of the signal sent from a main controlling part 12. A pump 9 of the ink sucking mechanism 8 is fixed to a predetermined position in the ink jet printer 1 and driven through a driving motor 19 and a shaft 20. The driving motor 19 is rotated to the direction indicated with an arrow C by receiving the electric signal sent from the sucking mechanism driving circuit 13 so as to let the pump 9 suck ink by this rotation of the driving motor 19.



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CLAIMS

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[Claim(s)]

[Claim 1] In the ink fuel injection equipment which attracts the ink supplied to the print head from the ink tank according to the ink suction device attached at the tip of the nozzle of a print head The first detection means which detects the existence of the above-mentioned ink tank, and the second detection means which detects the residue of the ink in an ink tank, The ink fuel injection equipment characterized by preparing the control section which controls the above-mentioned suction device driving means based on the output of the suction device driving means which makes adjustable the amount of suction of the ink of the above-mentioned ink suction device, the detection means of the above first, and the second detection means.

[Claim 2] The above-mentioned control section is a claim [claim 3] which makes [ most ] the amount of suction of ink immediately after ink exchange, and reduces the amount of suction of ink according to the residue of the ink in the above-mentioned ink tank. The above-mentioned suction device driving means is claim 1 which makes the amount of suction of ink adjustable, or an ink fuel injection equipment according to claim 2 by controlling the operating time of the above-mentioned ink suction device.

[Claim 4] The above-mentioned suction device driving means is claim 1 which makes the amount of suction of ink adjustable, or an ink fuel injection equipment according to claim 2 by controlling the actuation rate of the above-mentioned ink suction device. An ink fuel injection equipment given in one.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to ink fuel injection equipments which print by breathing out ink from the tip of a nozzle, such as an ink jet printer.

[0002]

[Description of the Prior Art] Conventionally, there are some which attract the ink supplied to the print head from the ink tank according to the ink suction device attached at the tip of the nozzle of a print head in ink fuel injection equipments which print by breathing out ink from the tip of a nozzle, such as an ink jet printer. An exchangeable ink tank is attached in the print head of an ink jet printer in one, and ink is supplied to the ink stores dept. of a print head through tubing from this ink tank. The print head is carried in movable carriage and records an alphabetic character, an image, etc. on the form set in the opposite location according to the inputted printing signal.

[0003] In such an ink jet printer, the ink suction device was attached at the tip of the nozzle of a print head immediately after exchange of an ink tank, ink was attracted, and the air which collected between an ink tank and tubing is extracted. Moreover, if the ink at the tip of a nozzle touches air and becomes hard, while not printing, since the poor regurgitation by ink plugging will happen, also before performing each printing, the ink suction device was attached at the tip of a nozzle, ink was attracted, and ink plugging has been removed. In addition, it is set up more mostly than the nozzle of a print head, an ink stores dept., and the amount of ink with which it fills up in tubing by the amount of suction of ink so that fully [ all before performing each printing immediately after ink tank exchange ] for extracting the air immediately after ink tank exchange.

[0004]

[Problem(s) to be Solved by the Invention] Although it is enough if it is in the conventional ink fuel injection equipment, and the ink of more amounts than the amount of ink with which it fills up in a nozzle is attracted in suction which removes ink plugging at the tip of the nozzle before performing each printing All before performing each printing immediately after ink tank exchange The nozzle and ink stores dept. of a print head, And since the ink of more amounts than the amount of ink with which it fills up in tubing was attracted, and the ink beyond the need would be attracted each time before performing each printing, a lot of ink became useless and there was a trouble that the utilization ratio of ink was bad.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, in the ink fuel injection equipment of this invention, the control section which controls a suction device driving means based on the output of the first detection means which detects the existence of an ink tank, the second detection means which detects the residue of the ink in an ink tank, the suction device driving means which makes adjustable the amount of suction of the ink of an ink suction device, the first detection means, and the second detection means prepared.

[0006] When the first detection means of the ink fuel injection equipment constituted as mentioned above detects being loaded with the ink tank and omits the first suction A control section makes an ink suction device attract the ink of sufficient amount for an air vent once

through a suction device driving means. Then, when the ink of sufficient amount to remove ink plugging is made to attract and it detects that the ink in an ink tank has few second detection means than the specified quantity before performing each printing, an ink suction device is made to suspend suction actuation through a suction device driving means.

[0007]

[Embodiment of the Invention] It explains referring to a drawing about the gestalt of operation of this invention. In addition, the same sign is given to an element common to each drawing. The control-block Fig. in which drawing 1 shows the ink jet printer of this invention, and drawing 2 are the explanatory views showing the interior of a print head of an ink jet printer. In drawing 2, the ink jet printer 1 which is an ink fuel injection equipment prints by breathing out ink from tip 3a of the nozzle 3 prepared two or more in the print head 2 movable in the direction of arrow-head A-A'. Ink is supplied to this print head 2 with tubing 6 from the exchangeable ink tank 5 with which the tank receptacle 4 was loaded. The ink supplied to the print head 2 through tubing 6 is once stored in the manifold 7 which is an ink stores dept. in a print head 2, and is supplied to each nozzle 3.

[0008] In such an ink jet printer 1, ink was attracted according to the ink suction device 8 from tip 3a of the nozzle 3 of a print head 2 immediately after exchange of the ink tank 5, and the air which collected between the ink tank 5 and tubing 6 is extracted. Moreover, if the ink at the tip of a nozzle 3 touches air and becomes hard, while not printing, since the poor regurgitation by ink plugging will happen, also before performing each printing, ink was attracted according to the ink suction device 8 from tip 3a of a nozzle 3, and ink plugging has been removed. The ink suction device 8 fixed to the predetermined location in an ink jet printer 1 consists of a pump 9 and siphon 10, and the cap 11 is attached at the tip of the siphon 10. The ink suction device 8 sucks ink out of the cap 11 attached in tip 3a of a nozzle 3 by driving a pump 9.

[0009] In drawing 1, the suction device drive circuit 13, the ink tank detection sensor 14, and the ink residue detection sensor 15 are connected to the main control section 12 of an ink jet printer 1. The ink suction device 8 mentioned above is connected to the suction device drive circuit 13, and the suction device drive circuit 13 controls the amount of the ink which the ink suction device 8 attracts based on the signal from the main control section 12.

[0010] It explains in more detail about an ink suction device which was mentioned above. The perspective view in which drawing 3 shows the ink suction device of an ink jet printer, the side elevation which looked at drawing 4 from [ of drawing 3 ] arrow-head B, and drawing 5 are the sectional side elevations showing the interior of a pump. In drawing 3 and drawing 4, the print head 2 is attached in the guide shaft 16 at the carriage 17 by which sliding support was carried out. The guide shaft 16 is formed in the direction which intersects perpendicularly to the conveyance direction of a record medium 18, and a both-way scan is possible for carriage 17 in the direction of arrow-head A-A'.

[0011] It is fixed to the position in an ink jet printer 1, and the pump 9 of the ink suction device 8 is connected with the drive motor 19 by the shaft 20. Moreover, the exhaust pipe 21 has projected from the pump 9 bottom. A drive motor 19 rotates in the direction of arrow-head C in response to the electrical signal from the suction device drive circuit 13 mentioned above, and a pump 9 attracts ink by this rotation.

[0012] In drawing 5, the siphon 10 inserted in the interior from the pump 9 bottom is connected with the exhaust pipe 21 which projects from the pump 9 bottom in accordance with the wall for a semicircle periphery of a pump 9. Moreover, the pressure 22 is being fixed to the shaft 20 which connects the drive motor 19 and pump 9 in drawing 3, and the tip of the height 23 of this pressure 22 is pressing the siphon 10 from the inside. Since the siphon 10 consists of an elastic member, the part pressed at the tip of the height 23 of a pressure 22 is dented, and when a pressure 22 rotates in the direction of arrow-head C with rotation of a drive motor 19, it has the structure of the ink in the siphon 10 being pressed and flowing to the exhaust pipe 21. That is, the amount of suction of the ink by the ink suction device 8 changes, and the suction device drive circuit 13 controls the operating time of this pressure 22 by the turnover time of a pressure 22.

[0013] Next, it explains in more detail about the ink tank detection sensor 14 and the ink residue

detection sensor 15 which were mentioned above. Drawing 6, the perspective view in which drawing 7 shows an ink tank detection sensor, the perspective view in which drawing 8 shows an ink residue detection sensor, drawing 9, and drawing 10 are the side elevations showing the interior of an ink tank. Drawing 6 and drawing 7 show the place which looked at the tank receptacle 4 which removed the carriage 17 in drawing 3 from arrow-head E. The microswitch 24 is attached in the tank receptacle 4 bottom in drawing 6. The hole 25 is formed in the pars basilaris ossis occipitalis of the tank receptacle 4, and the contact piece 26 has projected from this hole 25. The contact piece 26 is movable in the direction of arrow-head F-F', and a microswitch 24 turns it on by being pushed in the direction of arrow-head F.

[0014] In drawing 7, if the heights prepared in the pars basilaris ossis occipitalis of the ink tank 5 are inserted in the insertion hole 27 prepared in the pars basilaris ossis occipitalis of the tank receptacle 4 and the tank receptacle 4 is loaded with the ink tank 5, a contact piece 26 is pushed in the direction of arrow-head F by the pars basilaris ossis occipitalis of the ink tank 5, and a microswitch 24 turns on. On the contrary, if the ink tank 5 is removed from the tank receptacle 4, the contact piece 26 pushed on the pars basilaris ossis occipitalis of the ink tank 5 moves in the direction of arrow-head F', and a microswitch 24 turns off. The on-off signal of this microswitch 24 is inputted into the main control section 1 in drawing 1 mentioned above.

[0015] In drawing 8, the ink residue detection sensor 15 is formed in the installation hole 28 formed in one side attachment wall inside the ink tank 5. In the installation hole 28, the post 29 has projected horizontally, and the coil spring 30 is held at this post 29. The contact electrode 31 is connected to the end of a coil spring 30, and the contact electrode 32 is formed in the opposite side of the contact electrode 31 on both sides of the post 29. When the contact electrodes 31 and 32 are connected to circuit patterns 33 and 34, respectively and the ink residue in the ink tank 5 decreases exceeding a predetermined value, an ink residue detecting signal is transmitted to the main control section 12 through these circuit patterns 33 and 34.

[0016] In drawing 9, a lot of ink 37 remains in the inner tank 36 within the outer case 35 of the ink tank 5. It is formed in the medial surface of the hippo 38 which the hole 28 is established in the outer case 35 by attaching, and fixed the contact electrodes 31 and 32 and circuit patterns 33 and 34 to the installation hole 28 of the ink tank 5 from the outside mentioned above. Other end 30a which the end of a coil spring 30 was always in contact with the contact electrode 31, and was formed in the U character mold is forced on the inner tank 36 in the condition of having been involved in the same side as the contact electrode 31, by the condition that ink 37 is filled in the inner tank 36.

[0017] In the condition that ink 37 is filled in the inner tank 36, the both ends of a coil spring 30 are inserted into the hippo 38 and the inner tank 36 with the post 29 down side. At this time, the contact electrodes 31 and 32 are non-switch-on. Printing actuation is performed, and if ink 37 is supplied to the manifold 7 of a print head 2 through the tubing 6 in drawing 2 and is breathed out from the nozzle 3, the inner tank 36 will be crushed with the pneumatic pressure which flows from an air hole 39.

[0018] Thus, if the inner tank 36 becomes small with reduction of ink 37 within the outer case 35 and is shrunk from post 29 to a lower part location, a coil spring 30 will rotate in the direction of arrow-head G of drawing 10. Other end 30a of a coil spring 30 connects with the contact electrode 32 by this rotation, and between the two electrodes of the contact electrodes 31 and 32 flows. Thereby, it is transmitted to the main control section 12 as an ink residue detecting signal from circuit patterns 33 and 34 that the ink residue became less than the predetermined value. After receiving an ink residue detecting signal, the main control section 12 detects having exhausted the ink 37 in the ink tank 5, when it carries out counting of the amount of printing with the counter which is not illustrated and performs the after that predetermined amount of printing.

[0019] It explains referring to a drawing about the ink suction actuation by the ink suction device 8 which was mentioned above. Drawing 11 is a flow chart which shows ink suction actuation. In drawing, if the depression of the printing key by which the operator was prepared in the case external surface which an ink jet printer 1 does not illustrate is carried out and a printing command is taken out with step 1 to the main control section 12, the main control section 12

will judge whether the microswitch 24 turns on at step 2.

[0020] It judges whether suction immediately after ink tank 5 exchange was performed at step 3 noting that the ink tank 5 is not immediately after exchange, when turned on. If a line is, it will judge whether the ink residue detection sensor 15 turns off at step 4. It judges whether the amount of printing after the ink residue detection sensor 15 turns on at step 5 is in the specified quantity noting that there are few residues of the ink 37 in the ink tank 5 than the specified quantity, when turned on.

[0021] An amount is usually attracted noting that ink 37 of enough is in the ink tank 5 at step 6, when it is in the specified quantity, and when the ink residue detection sensor turns off at step 4. That is, the ink 37 of more [ slightly ] amounts than the ink with which carries out the predetermined time drive of the drive motor 19 of a pump 9, and the suction device drive circuit 13 mentioned above is filled up in the nozzle 3 of a print head 2 is attracted. When judged with the amount of printing after the ink residue detection sensor 15 turns on at step 5 being over the specified quantity, a display means etc. informs an operator of it being an ink end at step 7.

[0022] A display means etc. informs an operator of that at step 8 noting that the tank receptacle 4 is not loaded with the ink tank 5, when the microswitch 24 turns off at step 2. When judged with omitting suction immediately after ink tank 5 exchange at step 2, an operator loads the tank receptacle 4 with the ink tank 5, and when judged with the microswitch 24 having turned on at step 9, the ink of the amount immediately after ink tank 5 exchange is attracted at step 10. That is, the ink of more [ slightly ] amounts than the ink 37 with which carries out the predetermined time drive of the drive motor 19 of a pump 9, and the suction device drive circuit 13 is filled up in the nozzle 3 of a print head 2, a manifold 7, and tubing 6 is attracted. Moreover, the main control section 12 memorizes having performed suction immediately after ink tank 5 exchange at step 11 in the storage section which is not illustrated.

[0023] Thus, the ink tank detection sensor 14 which detects the existence of the ink tank 5, The ink residue detection sensor 15 which detects the residue of the ink in the ink tank 5, The suction device drive circuit 13 which makes adjustable the amount of suction of the ink 37 of the ink suction device 8, By having formed the main control section 12 which controls the suction device drive circuit 13 based on the output of the ink tank detection sensor 14 and the ink residue detection sensor 15 Since the ink 37 of a necessary minimum amount is attracted according to the residue situation of the ink tank 5 and ink 37, the utilization ratio of ink improves.

[0024] In addition, in the gestalt of this operation, in ink suction immediately after ink tank 5 exchange, although the suction device drive circuit 13 controlled the operating time of a pressure 22 and the ink of the specified quantity was attracted, the suction device drive circuit 13 may attract the ink of the specified quantity by controlling the actuation rate of a pressure 22 within between the time amount which usually attracts an amount, and coincidence. In this case, immediately after ink tank 5 exchange, rather than the time of usually attracting an amount, rotational speed of a pressure 22 is made quick and it draws in at a quick rate. This becomes possible to shorten the suction time amount immediately after ink tank 5 exchange. Moreover, ink plugging in a nozzle 3 is also efficiently cancelable by drawing in quickly.

[0025]

[Effect of the Invention] Since this invention is constituted as explained above, it does so effectiveness which is indicated below.

[0026] Namely, the first detection means which detects the existence of an ink tank and the second detection means which detects the residue of the ink in an ink tank, By having prepared the control section which controls a suction device driving means based on the output of the suction device driving means which makes adjustable the amount of suction of the ink of an ink suction device, the first detection means, and the second detection means Since the ink of a necessary minimum amount is attracted according to the residue situation of an ink tank and ink, the utilization ratio of ink improves.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the control-block Fig. showing the ink jet printer of this invention.

[Drawing 2] It is the explanatory view showing the interior of a print head of an ink jet printer.

[Drawing 3] It is the perspective view showing the ink suction device of an ink jet printer.

[Drawing 4] It is the side elevation seen from [ of drawing 3 ] arrow-head B.

[Drawing 5] It is the sectional side elevation showing the interior of a pump.

[Drawing 6] It is the perspective view showing an ink tank detection sensor.

[Drawing 7] It is the perspective view showing an ink tank detection sensor.

[Drawing 8] It is the perspective view showing an ink residue detection sensor.

[Drawing 9] It is the sectional side elevation showing the interior of an ink tank.

[Drawing 10] It is the sectional side elevation showing the interior of an ink tank.

[Drawing 11] It is the flow chart which shows ink suction actuation.

[Description of Notations]

1 Ink Jet Printer

2 Print Head

3 Nozzle

5 Ink Tank

8 Ink Suction Device

12 Main Control Section

13 Suction Device Drive Circuit

14 Ink Tank Detection Sensor

15 Ink Residue Detection Sensor

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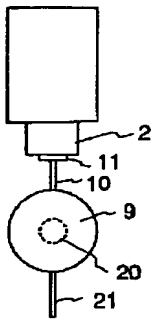
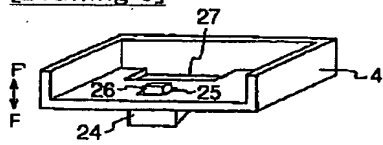


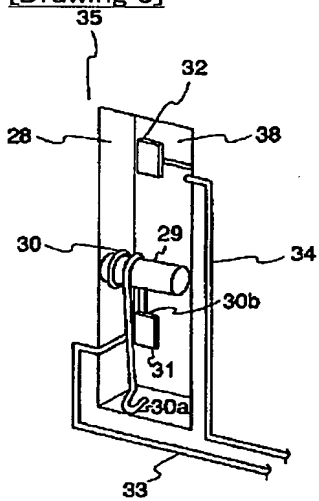
図3の矢印B方向から見た側面図

[Drawing 6]



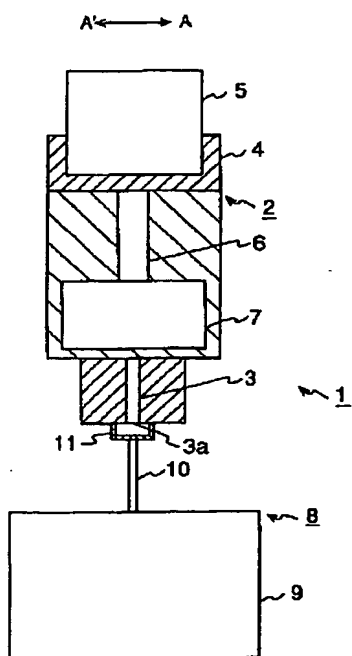
インクタンク検出センサを示す斜視図

[Drawing 8]



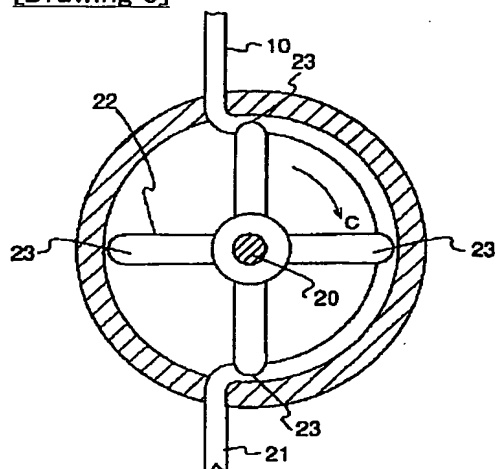
インク残量検出センサを示す斜視図

[Drawing 2]



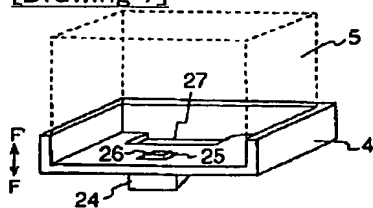
インクジェットプリンタの印字ヘッド内部を示す説明図

[Drawing 5]



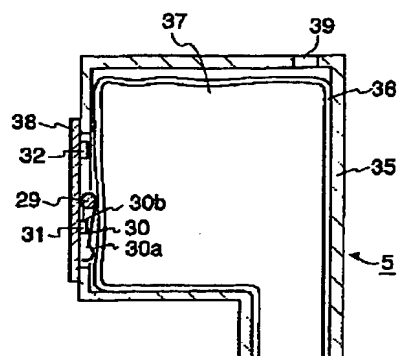
ポンプ内部を示す側断面図

[Drawing 7]



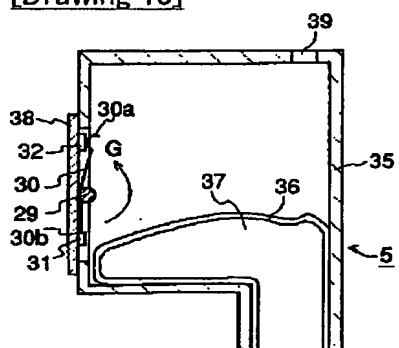
インクタンク検出センサを示す斜視図

[Drawing 9]



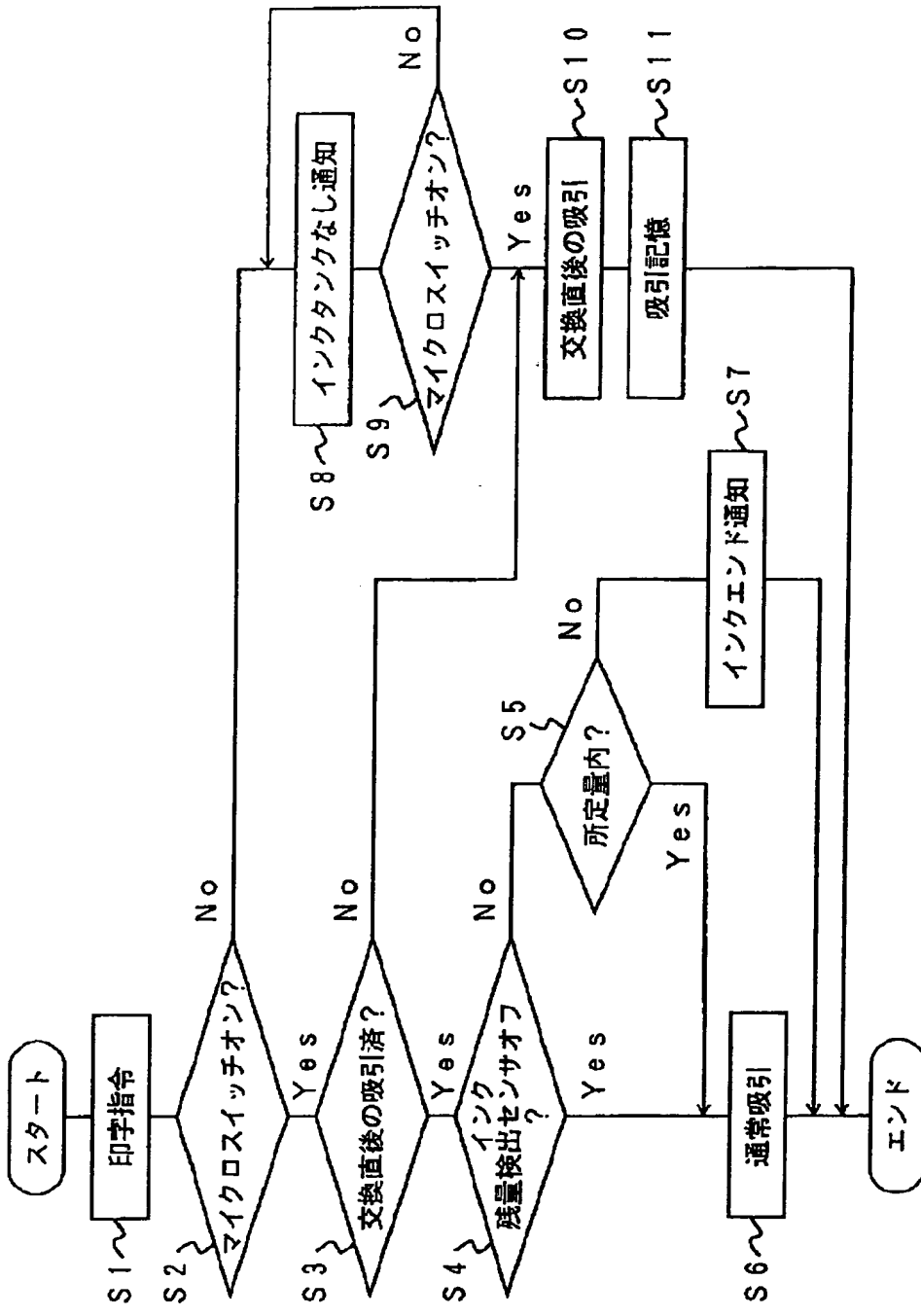
インクタンクの内部を示す側断面図

[Drawing 10]



インクタンクの内部を示す側断面図

[Drawing 11]



インク吸引動作を示すフローチャート

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